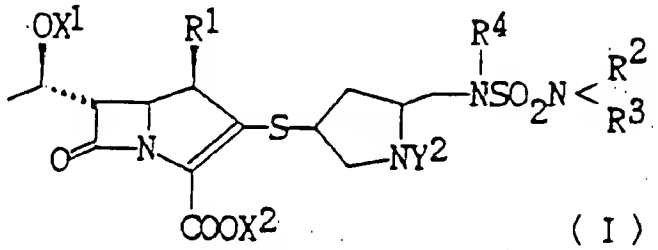
What is claimed is:

1. A pyrrolidylthiocarbapenem derivative represented by Formula I:



(I)

wherein R^1 is hydrogen or lower alkyl; R^2, R^3 and R^4 are hydrogen, lower alkyl which can be substituted, or an amino protecting group independently, or R^2 and R^3 together with a nitrogen atom to which R^2 and R^3 are bonded form a saturated or unsaturated cyclic group, or R^2 and R^4, or R^3 and R^4 together with two nitrogen atoms and one sulfur atom in the sulfamide group form a saturated or unsaturated cyclic group; each cyclic group can further include at least one atom selected from the group consisting of oxygen, sulfur and nitrogen, and each cyclic group can be substituted; X^1 is hydrogen or a hydroxy protecting group; X^2 is hydrogen, a carboxy protecting group, an ammonio group, an alkali metal or an alkaline-earth metal; and Y^2 is hydrogen or an amino protecting group.

2. A pyrrolidylthiocarbapenem derivative according to claim 1, wherein R^1 is methyl.

3. A pyrrolidylthiocarbapenem derivative according to claim 2, wherein R^4 is hydrogen.

4. A pyrrolidylthiocarbapenem derivative according to claim 3, wherein X^1 and Y^2 are hydrogens and X^2 is hydrogen or alkali metal.

5. A pyrrolidylthiocarbapenem derivative according to claim 4, wherein R^2 and R^3 are hydrogens; R^2 is methyl and R^3 are hydrogen; both R^2 and R^3 are methyl; or R^2 is 2-hydroxyethyl, and R^3 are hydrogen.

6. A pyrrolidylthiocarbapenem derivative according to claim 2, wherein R^3 is hydrogen, and R^2 and R^4 are bonded to each other to form $-CH_2-CH_2-$.

7. A pyrrolidylthiocarbapenem derivative according to claim 2, wherein R^3 is hydrogen, and R^2 and R^4 are bonded to each other to form $-CH_2-CH_2-CH_2-$.

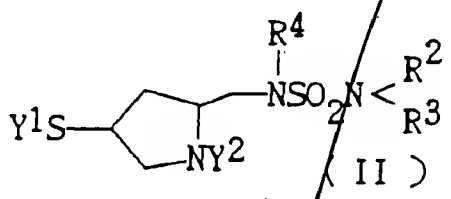
8. A pyrrolidylthiocarbapenem derivative according to claim 1, wherein at least one group selected from the group consisting of R^2, R^3, R^4 and Y^2 is selected from the group consisting of t-butyloxy carbonyl, allyloxycarbonyl, p-nitrobenzyloxycarbonyl, p-methoxybenzyloxycarbonyl and diazo.

9. A pyrrolidylthiocarbapenem derivative according to claim 1, wherein X^1 is selected from the group consisting of hydrogen, trimethylsilyl, triethylsilyl and t-butoxydimethylsilyl.

10. A pyrrolidylthiocarbapenem derivative according to claim 1, wherein X^2 is selected from the group consisting of hydrogen, sodium, potassium, t-butyl, allyl, p-nitrobenzyl, p-methoxybenzyl and diphenylmethyl.

11. A pyrrolidylthiocarbapenem derivative according to claim 1, wherein the pyrrolidine ring in Formula I has a configulation of (3S,5S).

12. A pyrrolidine derivative represented by Formula II:

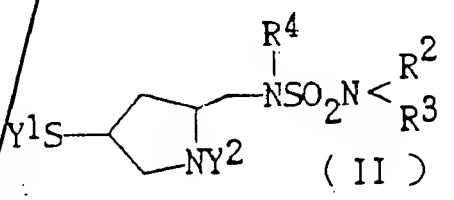


(II)

wherein R^2, R^3 and R^4 are hydrogen, lower alkyl which can be substituted, or an amino protecting group independently, or R^2 and R^3 together with a nitrogen atom to which R^2 and R^3 are bonded form a saturated or unsaturated cyclic group, or R^2 and R^4, or R^3 and R^4 together with two nitrogen atoms and one sulfur atom in the sufamide group form a saturated or unsaturated cyclic group; each cyclic group can further include at least one atom selected from the group consisting of oxygen, sulfur and nitrogen, and each cyclic group can be substituted; Y^1 is hydrogen or a mercapto protecting group; and Y^2 is hydrogen or an amino protecting group.

13. A pyrrolidine derivative according to claim 12, wherein R^4 is hydrogen.

14. A method for producing a pyrrolidine derivative represented by Formula II:



(II)

wherein R^2, R^3 and R^4 are hydrogen, lower alkyl which can be substituted, or an amino protecting group independently, or R^2 and R^3 together with a nitrogen atom to which R^2 and R^3 are bonded form a saturated or unsaturated cyclic group, or R^2 and R^4, or R^3 and R^4 together with two nitrogen atoms and one sulfur atom in the sufamide group form a saturated or unsaturated cyclic group; each cyclic group can further include at least one atom selected from the group consisting of oxygen, sulfur and nitrogen, and each cyclic group can be substituted; Y^1 is hydrogen or a mercapto protecting group; and Y^2 is hydrogen or an amino protecting group;

the method comprising the steps of:

converting a hydroxy group at the 4-position of a 4-hydroxypyrrolidine-2-carboxylic acid derivative into a mercapto group;

converting a carboxy group at the 2-position into a hydroxymethyl group;

converting a hydroxy group in the hydroxymethyl group into an amino group; and

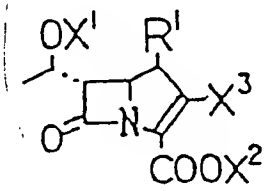
converting the amino group into a sulfamido group.

15. A method according to claim 14, wherein R^4 is hydrogen.

16. A method for producing a pyrrolidylthiocarbapenem derivative comprising the step of:

allowing a carbapenem derivative to react with the pyrrolidine derivative of claim 12 to obtain the pyrrolidylthiocarbapenem derivative of claim 1;

the carbapenem derivative being represented by Formula III:



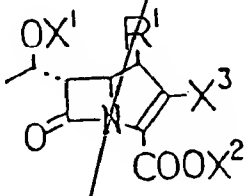
(III)

wherein R^1 is hydrogen or lower alkyl; X^1 is hydrogen or a hydroxy protecting group; X^2 is hydrogen, a carboxy protecting group, an ammonio group, an alkali metal or an alkaline-earth metal; and X^3 is a leaving group.

17. A method for producing a pyrrolidylthiocarbapenem derivative comprising the step of:

allowing a carbapenem derivative to react with the pyrrolidine derivative according to claim 13 to obtain the pyrrolidylthiocarbapenem derivative of claim 2;

the carbapenem derivative being represented by Formula III:



(III)

wherein R^1 is hydrogen or lower alkyl; X^1 is hydrogen or a hydroxy protecting group; X^2 is hydrogen, a carboxy protecting group, an ammonio group, an alkali

NP
NK

metal or an alkaline-earth metal; and X^3 is a leaving group.

12

~~18~~. An antibacterial agent comprising an effective amount of the pyrrolidylthiocarbapenem derivative of claim 1 as an active ingredient.

13

~~19~~. An antibacterial agent comprising an effective amount of the pyrrolidylthiocarbapenem derivative of claim 4 as an active ingredient.

14

~~20~~. An antibacterial agent comprising an effective amount of the pyrrolidylthiocarbapenem derivative of claim 5 as an active ingredient.

15

~~21~~. An antibacterial agent comprising an effective amount of the pyrrolidylthiocarbapenem derivative of claim 11 as an active ingredient.

16

~~22~~. A method for inhibiting growth of bacteria sensitive to the pyrrolidylthiocarbapenem derivative of claim 1 by allowing the sensitive bacterium to be in contact with an effective amount of the pyrrolidylthiocarbapenem derivative.